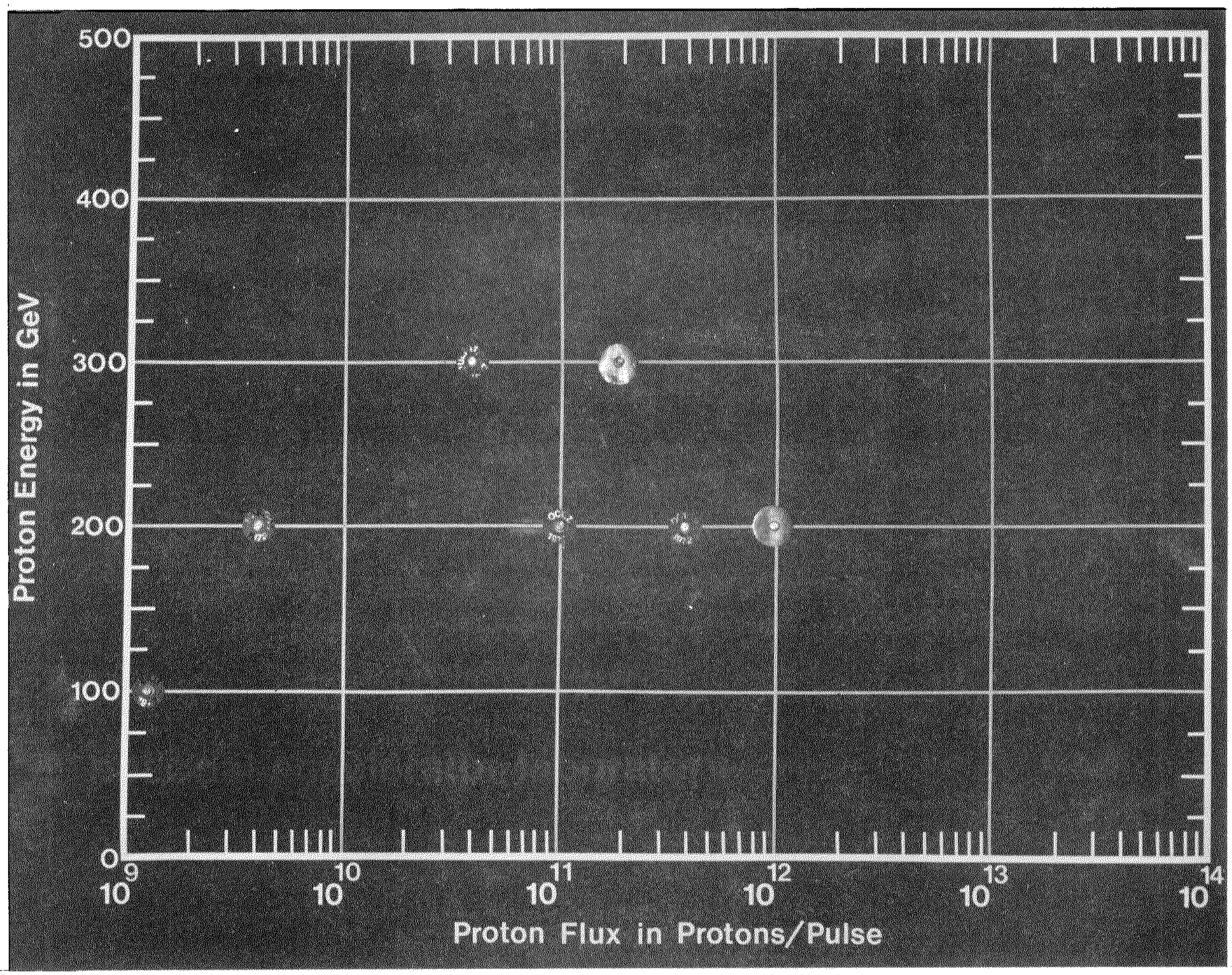
national accelerator laboratory

FERMILAB-NAL-082

0090.01

MONTHLY REPORT OF ACTIVITIES

November 30, 1972



10^{12} PROTONS PER PULSE ACCELERATED

Operated by Universities Research Association Inc. Under Contract with the United States Atomic Energy Commission

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Abstract: This report summarizes the activities of the National Accelerator Laboratory in November, 1972.

Operating Record

	Hours	Per Cent
Beam Delivered for High Energy Physics*	236	32
Accelerator Studies*	100	14
Start-Up	50	7
Tuning During Operations	56	8
Accelerator Failure	199	28
Accelerator Off (other causes)	13	2
Scheduled Shutdown	66	9
	720	100

*Internal target also operated periodically during accelerator studies.

Internal Target Section

The hydrogen jet operated through the month of November with 58 hours of beam interaction. Experiments 36, 120, 67, and 63 continued to take data during November (see Fig. 1).

Meson Section

A 48-hour operating period was scheduled for the 9th through 11th of November. About 8 hours of good beam time were available. During this time flux measurements in M3, M4, and M2 were made which agreed within a factor of two with our proton intensity as measured by a SWIC in front of the target. This improvement is attributed to improved alignment of the target load and beam lines.

Proton Section

November was a rather frustrating month for the continued proton beam tuning studies, which are being done mainly by Tom Nash with help from John Peoples, Dave Eartly, and Lincoln Read. Little progress was made in understanding the beam in two very short runs. However, an important step, pulse sharing, i.e., n pulses were transported to Proton Area then m pulses were directed to the Neutrino Area, was successfully carried out.

Neutrino Section

The Neutrino Area activity during the month of November was devoted to running the 30-in. bubble chamber beam line (N9-N7-N3) simultaneously with the Muon Line (N1) and the Neutrino Target Train (N0). This was accomplished by using the pulsed bypass magnets in the Neutrino Target Hall. These magnets switch a fraction of the beam from a trajectory toward the trainload into a path which bypasses the load.

This feature allowed Muon Experiment #26, Neutrino Experiment #21, and Monopole Experiment #76 to take data while pictures were being taken in the 30-in. bubble chamber for Experiment #141 (proton-proton scattering at 205.2 GeV).

At the end of the run which lasted through the Thanksgiving holiday, the 50,000 picture run for Experiment #141 had been completed, 10,000 pictures had been taken for Experiment #2-I, Experiment #26 had received several times 10^7 muons and Experiment #21 reported 8 neutrino events.

During this period, Experiment #95 studied background in the Neutrino Target Hall and the Monopole #76 target was exposed to approximately 10^{16} protons.

Experiment #2B obtained 10,000 bubble-chamber pictures and about 7,000 triggered spark-chamber photographs. This marks the first exposure of the downstream hybrid system directed to doing an experiment rather than first testing the equipment.

Experiment #154 group successfully operated the proportional-chamber system upstream of the bubble chamber, both for assisting in beam monitoring and for tagging incoming beam particles for Experiment #2B.

Accelerator

On November 6, the booster was returned from 7.2 GeV to its design energy of 8 GeV. It had earlier been operated at 8 GeV, but continuous operation was not possible because of insufficient rf voltage. These problems have now been largely solved and 8-GeV operation is now routine and stable.

E. Hubbard and R. Peters report that as many as nine booster pulses have been loaded into a single main-ring cycle and accelerated. We have operated over long periods with five booster pulses per main-ring cycle. This operation is possible because the weaker blocking capacitors are now being replaced by new ceramic capacitors as those are delivered.

The beam-abort system has been put into operation at D0 and is being used to dispose of beam at the end of every pulse. The abort system consists of two bump magnets, one each at stations C46 and D17, which induce a one-wave length horizontal orbit bump. The beam is bumped onto a 6 ft long Al target located upstream in long straight section D. The secondaries from the target are stopped in two 20 ft long aperture scrapers located downstream in long straight section D. The scrapers are formed out of main-ring bending magnet yokes. At 200 GeV, the entire beam is wiped out on the target in 3-4 turns, corresponding to the 5 msec rise time of the bump magnets. The radiation level during abort and the buildup of radioactivity of the target and the scrapers are monitored.

There has been some progress in experiments to understand the orbit properties of the main accelerator. R. Stiening has found evidence of non-linear resonant effects at injection that certainly affect beam loss. D. Jovanovic has measured beam lifetime as a function of energy. Except for the point at injection, his preliminary results are not in disagreement with gas scattering as a cause of beam loss. More work is needed to understand the optics of the 8-GeV line and injection.

Helen Edwards reports that the gross structure of the slow-extracted beam has been made significantly smoother by application of feedback from the beam signal to an iron-core quadrupole at A32 that acts to correct the tune. An air-core quadrupole at A26 is designed to reduce the fine structure of the extracted beam, but hardware troubles have so far prevented its coming into operation.

A major achievement in November was pulse sharing. Alternate accelerated pulses have been transported to the Proton Area and the Neutrino Area. Preparations are underway for installation of the first splitting station to share individual pulses between the Proton and Neutrino Areas. This installation will take place in December.

J. Griffin has measured the emittance of the extracted beam in the Transfer Hall and in the Neutrino Hall. In the Transfer Hall, the horizontal emittance is 0.14 π mm-mrad, approximately half the design value. The vertical emittance is 0.08 π, close to the design value. In Neutrino Hall, both emittances are several times larger, presumably because of flags, air gaps, and windows in the transport line.

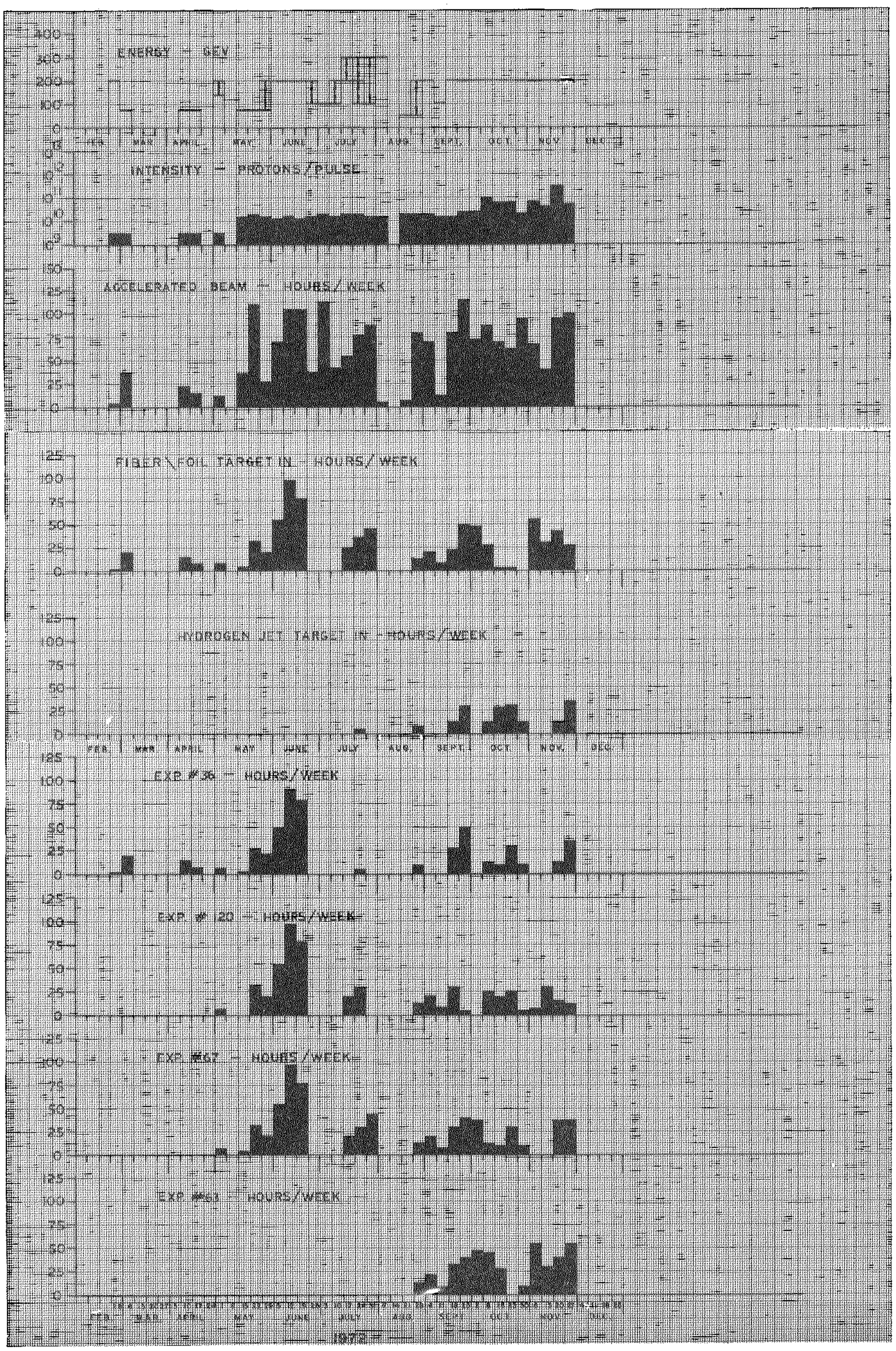

Fig. 1. Unofficial tally of use of beam by Internal Target Section.